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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/804,430	03/19/2004	Jisoo Kim	LMRX-P032/P1205	7228
32986	7590	11/15/2005	EXAMINER	
IPSG, P.C. P.O. BOX 700640 SAN JOSE, CA 95170-0640			VINH, LAN	
			ART UNIT	PAPER NUMBER
			1765	
DATE MAILED: 11/15/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/804,430	<b>Applicant(s)</b> KIM ET AL.	
	<b>Examiner</b> Lan Vinh	<b>Art Unit</b> 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 19 March 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-22 and 25-39 is/are rejected.
- 7) ☒ Claim(s) 3,4,23 and 24 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>030805</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-2, 5-8, 13, 15, 17, 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Soda et al (US 2003/0190807)

Soda discloses a method for manufacturing a semiconductor device having a substrate, the substrate having a semi-conductor layer 18, a first barrier layer 19 of SiC disposed above said semi conductor layer, a low-k layer 20 disposed above said first barrier layer 19, a SiC layer 21/third hardmask layer disposed above said low-k layer; a SiC layer 23/second hard mask layer disposed above layer 21/ third hard mask layer, and a layer 24/first hard mask layer disposed above said second hard mask layer, the method comprising:

partially etching/alternatively etching said substrate with CF<sub>4</sub> gas/ first etchant and C<sub>4</sub>F<sub>8</sub> gas/a second etchant, wherein the first etchant etches layer 24, 23, 22 (col 3, paragraph 0045; fig. 6A), which reads on the first etchant has a low selectivity to a first hard mask material of said first hard mask layer, a third hard mask material of said a

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third hard mask layer, and a first barrier layer material of said first barrier layer, but a high selectivity to a second hard mask material of said second hard mask layer

the C4F8 gas/second etchant etches layers 20, 22 (col 3, paragraph 0045; fig. 6C), which reads on wherein said second etchant has a high selectivity to said first hard mask material of said first hard mask layer, said third hard mask material of said third hard mask layer, and said first barrier layer material of said first barrier layer, and said first second etchant has a low selectivity to said second hard mask material of said second hard mask layer.

The limitations of claims 2, 13, 15, 17, 20 have been discussed above

Regarding claims 5-6, Soda discloses forming a layer 22/second barrier layer formed between the layer 21/third hardmask and low-k layer 20, the C4F8/second etchant etches through the layer 22 (col 3, paragraph 0045)

Regarding claims 7, Soda discloses using C4F8/second etchant to etch portion of layer 23/second hardmask, the low-k layer and layer 22/second barrier layer simultaneously (col 3, paragraph 0048; fig. 6C)

Regarding claim 8, fig. 6 C shows that the layers 23/second hardmask, low-k layer 20 and layer 22/second barrier layer are patterned for a dual damascene method

3. Claims 21-22, 25-27, 32, 34, 36, 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Soda et al (US 2003/0190807)

Soda discloses a method for manufacturing a semiconductor device having a substrate, the substrate having a semi-conductor layer 18, a first barrier layer 19 of SiC

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disposed above said semi conductor layer, a low-k layer 20 disposed above said first barrier layer 19, a layer 22/second barrier layer formed above the low-k layer 20, a SiC layer 21/third hardmask layer disposed above said low-k layer; a SiC layer 23/second hard mask layer disposed above layer 21/ third hard mask layer, and a layer 24/first hard mask layer disposed above said second hard mask layer, the method comprising:

partially etching/alternatively etching said substrate with CF<sub>4</sub> gas/ first etchant and C<sub>4</sub>F<sub>8</sub> gas/a second etchant, wherein the first etchant etches layer 24, 23, 22 (col 3, paragraph 0045; fig. 6A), which reads on the first etchant has a low selectivity to a first hard mask material of said first hard mask layer, a third hard mask material of said a third hard mask layer, and a first barrier layer material of said first barrier layer, but a high selectivity to a second hard mask material of said second hard mask layer

the C<sub>4</sub>F<sub>8</sub> gas/second etchant etches layers 20, 22 (col 3, paragraph 0045; fig. 6C), which reads on wherein said second etchant has a high selectivity to said first hard mask material of said first hard mask layer, said third hard mask material of said third hard mask layer, and said first barrier layer material of said first barrier layer, and said first second etchant has a low selectivity to said second hard mask material of said second hard mask layer and the second barrier layer

The limitations of claims 22, 25, 32, 34, 36, 39 have been discussed above

Regarding claims 5-6, Soda discloses forming a layer 22/second barrier layer formed between the layer 21/third hardmask and low-k layer 20, the C<sub>4</sub>F<sub>8</sub>/second etchant etches through the layer 22 (col 3, paragraph 0045)

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Regarding claim 26, Soda discloses using C4F8/second etchant to etch portion of layer 23/second hardmask, the low-k layer and layer 22/second barrier layer simultaneously (col 3, paragraph 0048; fig. 6C)

Regarding claim 27, fig. 6 C shows that the layers 23/second hardmask, low-k layer 20 and layer 22/second barrier layer are patterned for a dual damascene method

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 9-10, 12, 14, 28-29, 31, 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soda et al (US 2003/0190807) in view of Daniels et al (US 6,583,047)

Soda method has been described above. Unlike the instant claimed inventions as per claims 9-10, 12, 14, 28-29, 31, 33, Soda fails to disclose forming the first hardmask/first barrier layer of SiN/SiC

Daniels, in a method of forming microelectronic device, discloses that hardmask layer can be formed of SiN or SiC (col 21, lines 15-20)

Hence, one skilled in the art at the time the invention was made would have found it obvious to modify Soda method by forming the first hardmask/first barrier layer of

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SiN/SiC as per Daniels because Daniels discloses that preferably the hardmask layer material is SiN or SiC (col 21, lines 18-20)

5. Claims 11, 16, 30, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soda et al (US 2003/0190807) in view of Gates et al (US 6,716,742)

Soda method has been described above. Unlike the instant claimed inventions as per claims 11, 16, 30, 35, Soda fails to disclose forming the second hardmask/second barrier layer of TEOS

Gates discloses a method for forming an interconnect comprises the step of forming an etch stop/hardmask of TEOS (col 5, lines 1-5)

One skilled in the art at the time the invention was made would have found it obvious to modify Soda method by forming the second hardmask/second barrier layer of TEOS in view of Gates teaching because Gates discloses that an etch stop layer/hardmask include TEOS, MSQ and any other Si-containing material (col 5, lines 1-6)

6. Claims 18, 19, 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soda et al (US 2003/0190807) in view of Tang et al (US 2001/0000246)

Soda method has been described above. Unlike the instant claimed inventions as per claims 18-19, 37-38, Soda fails to disclose using the etchant of CHF<sub>3</sub> and C<sub>4</sub>F<sub>6</sub>/fluorocarbon

Tang discloses a dielectric etch process comprises the step of etching dielectric layers using CHF<sub>3</sub> and fluorocarbons (col 5, paragraph 0053)

One skilled in the art at the time the invention was made would have found it obvious to modify Soda method by using the etchant of CHF<sub>3</sub> and fluorocarbon as per Tang because Tang discloses that for the oxide/nitride compositions, the selective etch is based on a fluorocarbon with a lean etchant of CHF<sub>3</sub> (see abstract)

***Allowable Subject Matter***

7. Claims 3-4, 23-24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims

***Conclusion***

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to be 'LV' followed by a stylized flourish.

LV

November 8, 2005